REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-22 are presently active in this case, claims 20-22 added by way of the present Amendment.

In the outstanding Office Action, claims 1-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,853,953 to Brcka et al. in view of U.S. Patent No. 6,592,710 to Benjamin et al.

First, Applicants wish to thank Examiner Paschall for the August 29, 2005 personal interview at which time the outstanding issues in this case were discussed. During the interview, Applicants presented amendments and arguments substantially as indicated in this response. Agreement was reached that the present claims patentably define over the cited references.

Turning now to the merits, Applicants' invention is directed to a method and apparatus for determining a plasma impedance. As discussed in the Background section of the present specification, plasma impedance is an important parameter for measuring the state of a process plasma. However, precise measurement of a plasma impedance requires placement of a voltage-current sensor at the interface of the plasma and chamber wall. The present inventors have recognized that it is impractical to make such a placement of a voltage-current sensor. Thus, Applicants' invention is directed to providing a plasma impedance measurement without the need for physically placing a voltage-current sensor at the plasma chamber interface.

Specifically, Applicants' claim 1 recites a plasma processing system including a chamber configured to contain a plasma and including a chuck within an interior area of the chamber the chuck including a support surface and a bottom surface. A first voltage-current probe is positioned at a first position located exterior to the chamber and on a radio frequency

transmission line between the chamber and a power source. Finally, a simulation module is connected to the first voltage-current probe and arranged to solve, based on measurements transmitted from the first voltage-current probe, a radio frequency model of the radio frequency transmission line between the first position and a second position located within the chamber. Thus, Applicants' claim 1 provides a voltage-current probe at a convenient location outside of the processing chamber, and uses a simulation module to model a portion of the transmission line extending from the voltage-current probe. Applicants' independent claims 10, 11, 18 and 19 also include this feature in different claim drafting formats. As described in Applicants' specification, a measured impedance outside the plasma chamber and a modeled portion of the RF line allows accurate calculation of the plasma impedance without the need for impractical placement of the voltage-current probe.[1]

In contrast, the cited reference to Brcka et al. discloses a method of characterizing the performance of an electrostatic chuck. As seen in Figure 2 of this reference, an impedance analyzer 66 can be placed on an RF transmission line leading to the electrostatic chuck 36 in order to qualify the performance of the electrostatic chuck. However, as apparently acknowledged by the outstanding Official Action, this reference in no way suggests simulating a portion of the transmission line leading to the electrostatic chuck.[2] However, the outstanding Office Action attempts to correct this deficiency by citing Benjamin et al.

Benjamin et al. discloses an apparatus and method for controlling voltage on a faraday shield in a plasma chamber. As seen in Figure 3 of this reference, an RF power supply 306 is attached to an antenna 302 through matching network 308. RF power on the antenna 302 is coupled to a faraday shield 304 by way of variable impedance component 318. Thus, the antenna 302 and faraday shield 304 share a common power supply. As also seen in Figure 3, a sensor 310 provides feedback to a power controller which adjusts power to the antenna 202.

[1] See Applicants' specification at ¶¶ 7-28.
[2] Official Action at page 2, lines 10-13.

A separate sensor 320 provides a voltage control feedback loop for the faraday shield. These two feedback loops allow independent voltage control of the faraday shield despite its using a common source with the antenna.

Applicants submit that nothing in Benjamin et al. suggests simulation of any portion of the RF transmission line leading to the antenna or the faraday shield. In this regard, Applicants note that the outstanding Official Action misinterprets the Benjamin et al. reference as teaching

> "[T]hat it is conventional to sense with two feedback or sensing circuits, to calculate the load and matching impedance and use of the two circuits compensates for both capacitive and inductive coupling of a power source to the load, leading to a more accurate load impedance matching."[3]

However, the Official Action does not point to any portion of Benjamin et al. for this teaching. As discussed in the August 29, 2005 interview, Benjamin et al. does not teach or suggest providing a voltage-current probe outside a plasma chamber and using a simulation module connected to the voltage-current probe and arranged to solve a radio-frequency model of the radio frequency transmission line between the voltage-current probe and a position within the chamber as required by Applicants' independent claims.

Thus, Applicants' independent claims 1, 10, 11, 18 and 19 patentably define over the cited references. Moreover, as the remaining pending claims in this case depend from one of the distinguished independent claims, these dependent claims also patentably define over the cited references. Nevertheless, Applicants have added claims 20-22, which emphasize that a plasma impedance within the chamber can be calculated based on the voltage-current measurements and the transmission line simulation. Neither Brcka et al. nor Benjamin et al. disclose measuring a plasma

[3] See outstanding Official Action at page 2.

impedance. Thus, claims 20-22 provide an additional basis for patentability over the cited references.

Finally, Applicants note that effective November 29, 1999, 35 U.S.C. § 103(c) provides that subject matter developed by another which qualifies as "prior art" only under one or more of subsections 35 U.S.C. § 102(e, f and g) is not to be considered when determining whether an invention sought to be patented is obvious under 35 U.S.C. § 103, provided the subject matter and the claimed invention were commonly owned at the time the invention was made. The cited reference to Brcka et al. qualifies as prior art only under 35 U.S.C. § 102(e) and is applied by the outstanding Official Action in a rejection under 35 U.S.C. § 103. However, the present application and Brcka et al. were, at the time the invention of the present application was made, owned or subject to assignment to Tokyo Electron Limited, Tokyo, Japan. Thus, in accordance with MPEP §706.02(l)(2)(II) the cited reference to Brcka et al. is disqualified from being used in a rejection under 35 U.S.C. § 103(a) against the claims of the present application.

Consequently, in view of the present Amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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